INQUIRY-BASED LEARNING AND GROWTH MINDSET IN THIRD GRADE MATHEMATICS

By

Katherine Klein

A capstone submitted in partial fulfillment of the requirements for the degree of Masters of the Arts in Teaching.

Hamline University

Saint Paul, Minnesota

December 2020

Capstone Project Facilitator: Trish Harvey
Content Expert: Linda Mannhardt

TABLE OF CONTENTS

CAPSTONE PROJECT

Project Summary

This project was created to answer the following question: *How can inquiry-based learning in Elementary mathematics help create a growth mindset?* I was a student who always struggled with mathematics. I always considered myself to not be a math person. After reflecting, I realized that my mindset was centered around the ways I had been taught mathematics. Educators need to rethink the way we teach math to our scholars.

This project is an introduction to a multiplication unit designed for third graders. The unit is planned for three weeks. Each lesson should take approximately one hour. The goal of this unit is for students to gain a conceptual understanding of multiplication, while also reflecting on their math mindset.

Scholars will gain a conceptual understanding of multiplication through the inquiries they will complete in a group. They will work in this group for the whole unit. Scholars will reflect on their math mindset in their math notebooks. After each lesson, students will be given a math mindset question to reflect on in their math notebooks. Teachers should give students around ten minutes to reflect and write in their notebooks.

This is an inquiry-based curriculum that follows a specific structure. Here are the steps of inquiry: discover, devise, develop, and defend. In the discovery phase, the teacher introduces an essential question or problem. Students use their prior knowledge to construct their own understanding. In the devise phase, students learn the requirements of the inquiry. In the

development phase, students implement their plan. Defending phase students present and defend their findings (Kogan et al., 2014).

The curriculum will begin by scholars and teachers completing the math mindset pre-assessment. The goal of this pre-assessment is for students to reflect on their math mindset and help them write a math goal for the unit. The math goal is something they should continue to think about throughout the math unit. Teachers should give students opportunities to change and reflect on their goal throughout the unit. At the end of the unit, students take the same math mindset assessment. Students are given time to compare their math mindset at the beginning of the unit, to what it is now. The hope is that students will see a shift in how they view mathematics from learning through inquiry-based learning.

The goal of week one is for scholars to get an introduction to growth versus fixed mindset as well as inquiry-based learning. Also, scholars will start to reflect on the relationship between addition and subtraction through repeated addition.

The curriculum follows the progression of multiplication. First students use their knowledge of skip counting to help them multiply. During the skip counting phase, scholars are asked to multiply by 2, 3, 4, and 5. Next scholars use derived combinations, where students use their knowledge of skip counting to help them multiply larger numbers. For example, if students are asked to multiply 7 by 6, they see the 7 as five 7s. They would then use their knowledge of skip counting by five to help them multiply by a number like 7 (Maryland Public Schools, 2020).

Next, students use arrays and equal groups to help them multiply. During this phase, it is really important to explain a row as a group. What this means is, students will see a row in an array as the same thing as an equal group. This will help students be able to see the relationship between arrays and creating equal groups. The goal is for students to use their known facts from

skip counting to help them solve using equal groups and arrays (Maryland Public Schools, 2020). In this part of the curriculum, students start to work with bigger numbers like 6, 7, 8, and 9.

The last phase in the progression is distributive property. The goal of this phase is for students to use known facts to help them solve unknown facts. Students will use the strategies they have learned in the rest of the unit to help them solve using the distributive property.

Each lesson has a solve and share. The goal of the solve and share is for students to apply their background knowledge and get prepared for what they will be learning in that day's lesson. Give students time to work independently, in a partnership, and discuss as a whole class. Each solve and share should take about ten minutes to complete.

This curriculum is designed for students to gain a conceptual understanding of multiplication while focusing on math mindset and inquiry-based learning. This is an introduction unit to multiplication. The curriculum sets the foundation for students in solving multiplication.

CURRICULUM DESIGN

Adapted from Wiggins & McTighe 2011

Stage 1 – Desired Results

ESTABLISHED GOALS

Goals:

-Use strategies to help them solve real world multiplication problems

-Students will be able to explain their thinking or strategy in a small group and whole class

-Students will be able to reflect on their math mindset before, during, and after the unit.

-Students will be able to ask questions about multiplication and investigate them in a small group.

Minnesota State Standards:

3.1.2.3 Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division.

3.1.2.4 Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.

Transfer

Students will be able to independently use their learning to…

T1: Solve real-world multiplication problems and explain their thinking and reasoning.

T2: Students will continue to reflect on their math mindset and how it may impact their performance in math.

Meaning

UNDERSTANDINGS

Students will understand that…

U1: Their math mindset and how it impacts their learning

U2: Of multiplication strategies and apply them to real-world scenarios

ESSENTIAL QUESTIONS

Students will keep considering…..

Q1: What impacts my math mindset and my attitude towards the subject? Did it change throughout the unit? What caused it to change?

Q2: What strategies can I use to help me solve multiplication problems?

Q3: How will I use multiplication in the real world?

Acquisition

Students will know…

K1: Students will know basic multiplication facts.

K2: Students will know multiplication strategies and be able to explain why they work.

K3: Students will know how monitor their math mindset

K4: Students will know how to ask questions and investigate them through the math process.

Students will be skilled at…

S1: Explaining strategies to help with multiplication problems.

S2: Reflecting on their math mindset before, during, and after the unit

S3: Asking questions about real-world multiplication and investigate them in small groups.

S4: Students will be skilled at working in small groups.

<table>
<tr><th colspan="2">Stage 2 – Evidence and Assessment</th></tr>
<tr><th>Evaluative Criteria</th><th>Assessment Evidence</th></tr>
<tr><td rowspan="2">-Inquiries completed by the student and their group.
-Journal reflections.
-Teacher observations.</td><td>PERFORMANCE TASK(S):
Students will show that they really understand by evidence of…
Solve real-world multiplication problems by using a strategy and be able to explain their thinking.</td></tr>
<tr><td>OTHER EVIDENCE:

Students will show they have achieved stage 1 goals by…
-Completing their inquiries with their group.
-Student participation in discussions
-Journal reflections with math mindset questions</td></tr>
<tr><th colspan="2">Stage 3 – Learning Plan</th></tr>
<tr><td colspan="2">Summary of Key Learning Events and Instruction

-Students identifying their math mindset and setting goals to help support that mindset
-Students solving real-world multiplication problems using their chosen strategy
-Gaining a conceptual understanding of multiplication
-Understanding the relationship between addition and subtraction
-Using their knowledge of skip counting to help multiply
-Using equal groups and arrays to help multiply
-Using known facts to help solve unknown facts—distributive property</td></tr>
</table>

UNIT ONE OVERVIEW

Unit 1 is a third grade introductory multiplication unit with an emphasis on growth mindset and inquiry-based learning. Each lesson should take around one hour. The unit should take approximately three weeks to complete. The teacher can take more than one day for a lesson, if that is what their students need.

Every lesson starts with a solve and share. The purpose of this is for students to get some exposure to what they will be learning that day. It gets them thinking about the new learning. Students start the solve and share individually. After a few minutes, they can discuss it with a partner or small group. Next, the teacher goes over the problem and students explain how they did it. This solve and share allows students to think of potential questions they will investigate that day.

Next, the teacher starts to introduce the inquiry of the day by sharing the driving question. This driving question is what the students will investigate throughout the inquiry. Students will continue to reflect on this question as they learn the new material.

Unit 1 also has math mindset activities that students complete in their math journals. There are specific questions students will answer every day. The math journal is a personal place where students can reflect on their math mindset. Throughout this unit, teachers should continue to think about the language they use with students and how it may impact students' math mindsets.

After completing the three week multiplication unit, there are two assessments. The first assessment is a multiplication assessment. Students will show their understanding of multiplication. The second assessment is a math mindset assessment.

Unit 1
Day 1

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can reflect on my math mindset. I can create a math goal for the upcoming unit.
Driving Question	**How do you think our mindset may affect our success in math?** -Students will turn and talk to discuss this question. Then debrief on what students think. -Next introduce students to the math mindset pre-assessment
Math Mindset Discussion/Question	Students will answer the following question in their math journal: *How do you think our mindset may affect our success in math?*
Resources:	Slides Math Mindset Pre-assessment
Solve and Share	**Julie has 3 bags of books. Each bag has 4 books. How many books does Julie have?** During the solve and share allow students a few minutes to try to solve the problem. Then have students work with a partner through the problem. After students have worked independently and with a partner, discuss some of the strategies students used. **Ask the following questions:** *What feelings did you have when solving this problem?* *What did you do when things got hard?*
Guided Practice/Inquiry	**Math Mindset Discussion:**

	-Discuss the following question: *How do you think our mindset may affect our success in math?* Students will turn and talk and share their ideas.
Independent Work Time	Students will complete the **Math Mindset Pre-Assessment**.
Closing	Today we reflected on our math mindset. We answered the question: **How do you think our math mindsets may affect our success in math?** Tomorrow, we will learn about **growth versus fixed** mindset! We will also look at our math mindset pre-assessment to help us create a goal for the math unit.

Name: _____

Math Mindset Pre-Assessment

What do you do when a math task gets hard?

A. Keep trying
B. Get frustrated
C. Give up
D. Ask for help

How do you feel about math?

_____

_____

_____

_____

_____

How do you feel when you make a mistake in math?

_____

_____

_____

_____

_____

Do you think everyone can be good at math?

a. Yes
b. No

What do you like about math?

What do you dislike about math?

Unit 1
Day 2

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can identify characteristics of growth mindset and fixed mindset. I can write a goal for the upcoming math unit.
Driving Question	*How do you think our growth or fixed mindset may affect our success in math?*
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *How do you think our growth or fixed mindset may affect our success in math?*
Resources:	Math Activities for Students to complete Goal Setting Worksheet Slides
Guided Practice	● Discussion of growth versus fixed mindset. Explain the definition of growth mindset and fixed mindset. ○ **Growth mindset=** A scholar who works through challenging tasks, and believes that their intelligence can grow and evolve. ○ **Fixed mindset**= A scholar who gives up easily, and believes their intelligence is what it is. After Math Activities: ● Discuss some strategies of things we can do when things may get challenging. ● Model how to set a math goal based on the challenges we faced during the activities.
Independent Work Time	● Students will be given challenging tasks to work on in a small group. Scholars will be thinking about the guided

	question through this process: *How do you think our growth or fixed mindset may affect our success in math?* ○ The worksheet has only a few problems. It is something that should only take about 15 min of math hour. ● Model how to create a math goal. Students will now set a math goal for themselves. This is a goal they will continue to reflect on throughout the unit. (The teacher will continue to model how to continue to reflect on our goal and when it may be time to create a new one)
Closing	Students can share their math goal with their small group.

Name: _____

Unit 1, Day 2 Activities

Directions: Work together to complete the following activities.
Guiding Question: *How do you think our growth or fixed mindset may affect our success in math?*

1. Third graders are going on a field trip to the zoo. There are 7 third grade classes. Each class has 28 students. How many students are going on the field trip? Show your work.

2. Write a story problem using 473+647.

Name:_____

Math Goal Worksheet

My first math goal:

My math goal is _____. I will accomplish this goal by_____.

Unit 1
Day 3

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can identify the characteristics of inquiry-based learning.
Driving Question	How can we find the total number of pieces of candy?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *How did you feel while completing the math activity? How did you overcome the challenges?*
Resources:	Slides IBL Worksheet
Solve and Share/ Problem Solving	Seth has 4 boxes of toys. Each box has 2 toys. How many toys does Seth have?
Guided Practice	**Discovery:** Teacher shows students 24 pieces of candy. Teacher says, "I have all this candy! I need to find out how many pieces of candy I have. I want to try to find a faster way, other than counting one by one. The sooner I count them, the sooner I can share them!" Introduce the driving question: *How can we find the total number of pieces of candy?* **Devise**: Teacher introduces the requirements of the inquiry. Teacher says, "Today you will work in small groups. These groups you will work in for our whole math unit. In your group, you will investigate ways we can figure out how many pieces of candy are in your bag. The only requirement is that you cannot count by 1 to figure out how many pieces of candy. Work together in your teams.

Independent Work Time	**Develop**: Students will get together with their group members. Students will create a plan for what they might try. They will record their plan on a worksheet. As a group, they must agree on the plan.
Closing	**Defend**: Students will present their findings to the group. Discus the driving question: *How can we find the total number of pieces of candy?*

Names: _____

Day 3
Objective: I can identify the characteristics of inquiry-based learning
Driving Question: How can we find the total number of pieces of candy?

Inquiry: Our class has some candy. Investigate ways we can figure out how many pieces of candy are in your bag. The only requirement is that you cannot count by 1 to figure out how many pieces of candy. Work together in your teams.

Our Plan:

Candy total:

Answer the following: How can we find the total number of pieces of candy?

_____

_____

_____

Unit 1
Day 4

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use repeated addition or multiplication to join equal groups.
Driving Question	How are addition and multiplication related?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *What was the main idea you learned today?*
Resources:	Farm Project Worksheet Exit Ticket
Solve and Share/ Problem Solving	Sara has 6 plates. Each plate has 2 potatoes. How many potatoes does she have in all?
Guided Practice	**Discovery**: Teacher says, "Third graders we have been working very hard on our addition. This unit is all about multiplication. Today I want you to explore the relationship between addition and multiplication. Today's driving question is: *How are addition and multiplication related?* During the discovery phase, discuss the driving question with the whole group. Give students the opportunity to turn and talk to a partner to discuss the question. Ask students what questions they have about the relationship between addition and multiplication. **Devise**: Our school is planning on creating a community garden. You are going to help us plan our garden. Your team will decide what each elementary grade will plant in our garden. Next, you will have to determine the total amount of seeds. Today you will explore strategies to help us find the number of seeds for each grade.

Independent Work Time	**Develop**: Students will use the Farm planning worksheet to plan their farm. They will decide what each grade level will plant. The group members will start to find the number of seeds each grade level will plant.
Closing	**Defend**: Students will share their plan with the class. They will share what each grade level will plant and how many packages they will need.

Names:_____

Community Farm Project

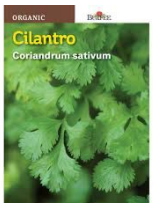
Day 4

Driving Question: **How are multiplication and addition related?**

Your group will need to pick what each grade will plant in the community garden:

1. **Kale**: 2 seeds in a package

2. **Cilantro:** 10 seeds in a package

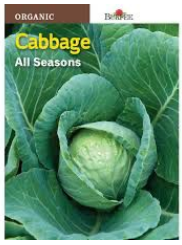


3. **Cucumber**: 5 seeds in a package

4. **Peppers**: 5 seeds per package

5. **Bok Choy**: 2 seeds per package

6: **Cabbage**: 2 seeds per package



Grade Level Picks

Each class in a grade will plant the same crop.

Grade Level	Number of Packages	Total Number of Seeds
Kindergarten		
1st Grade		
2nd Grade		
3rd Grade		
4th Grade		
5th Grade		

Use the space below to find the total number of seeds per group.

Our Strategies:

Day 4 Exit Ticket

I can describe how multiplication and addition are related.

 I've got it!	 I'm struggling and learning	 I need help

Questions I have:

Unit 1
Day 5

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use repeated addition or multiplication to join equal groups.
Driving Question	How are multiplication and addition related?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *What questions do you still have?*
Resources:	Farm Project Exit Ticket
Solve and Share/ Problem Solving	Solve: 4+4+4=____ 4x__=12 *What patterns do you notice between these two number sentences?
Guided Practice	**Discovery**: Today we will continue to explore the relationship between multiplication and addition. Yesterday we started to plan our farms. We will continue that work today. We will investigate the following question: *How are multiplication and addition related?* **Devise:** Yesterday we started to plan our community garden. Today we will continue to find the total number of seeds for each grade level.

Independent Work Time	**Develop:** Students will continue to find the total number of seeds for each grade level. Students should complete the reflection questions.
Closing	**Defend:** Students will present their findings to the class.

Day 5 Farm Project Continued

Reflection Questions: Answer the following questions with your group.

1. What patterns do you notice between multiplication and addition?

_____

_____

_____

_____

2. How does addition help us multiply?

_____

_____

_____

_____

Unit #: 1
Day 6
Skip Counting Twos

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use skip counting to help me multiply by two.
Driving Question	How can skip counting help us multiply by 2?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *What strategy did your group use to solve the inquiry today? Was your strategy successful? What did you learn from your strategy?*
Resources:	Unit 1, day 6 worksheet
Solve and Share/ Problem Solving	Skip counting game: First, review skip counting by 2. Students stand in a circle. In the circle, students will skip count by 2 until we reach 14. When the student says 14, they are out. Then students start at 2 again. This process continues until there is one person standing. Discussion: What patterns do you notice? "I want us to start to think about how skip counting may help us with multiplication. We will be taking a few days to use skip counting to help us multiply."
Guided Practice	**Discovery:** Discussion with students about the driving question and skip counting. Ask: "What does it mean to skip count?" Discussion: Today we are going to explore how skip counting can help us multiply. Today our driving question will be, ``*How can skip counting help us multiply?"*

	Devise: Our school is getting a new library. The librarian needs our help in finding the total number of books on your bookshelf. The books are wrapped in packages. Each package has two books. Your task to find the total number of books on your bookshelf. Remember, you will be investigating the question: how can skip counting help us multiply? Make sure to show your work on your day 6 worksheet.
Independent Work Time	**Develop**: Students work together in their team. They will create a plan with their day 6 worksheet.
Closing	**Defend**: Students will present their findings to the class. Discuss the driving question: H*ow can skip counting help us multiply?*

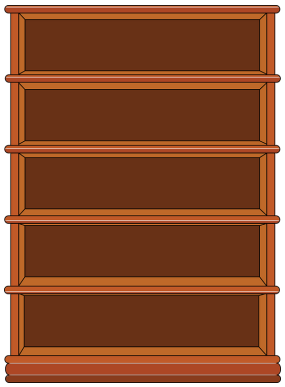
Names:_____

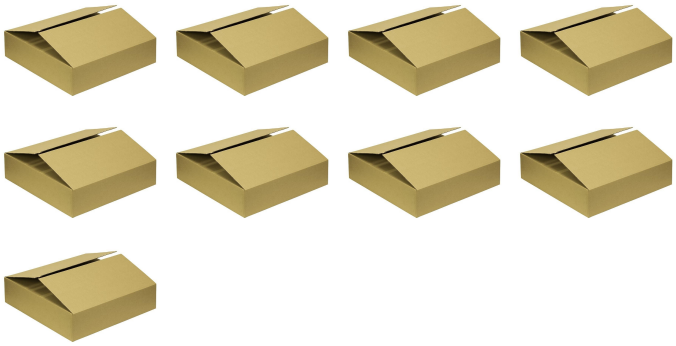
Day 6

Driving Question: How can skip counting help us multiply?

Objective: I can use skip counting to help me multiply.

Inquiry: Our school is getting a new library. The librarian needs our help in finding the total number of books on your bookshelf. The books are wrapped in packages. Each package has two books. The bookshelf has 9 packages. How many books are there in all?





Plan:

Our Work:

Total number of books:

Addition Sentence:

Multiplication Sentence:

Answer the following: How can skip counting by two help you multiply?

_____

_____

_____

_____

_____

_____

_____

Unit 1
Day 7

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use skip counting to help me multiply by five.
Driving Question	How can skip counting help us multiply by five?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *Explain a misconception or mistake a classmate or you made. What did you learn from the mistake or misconception?*
Resources:	Unit 1, day 7 worksheet
Solve and Share/ Problem Solving	Skip counting game: First, review skip counting by 5. Students stand in a circle. In the circle, students will skip count by 5 until we reach 30. When the student says 30, they are out. Then students start at 5 again. This process continues until there is one person standing. Discussion: What patterns do you notice? "I want us to start to think about how skip counting may help us with multiplication. We will be taking a few days to use skip counting to help us multiply."
Guided Practice	**Discovery**: Yesterday we explored skip counting by twos to help us multiply by two. Today we are going to explore skip counting by five to help us multiply by five. We will continue to investigate *How can skip counting help us multiply?*

	Devise: Yesterday, we helped our school librarian find the total number of books on our bookshelf. Today we will continue to help our school librarian set up the library. We are going to help the school librarian find out how many mice are in six packages. Make sure to use skip counting to help you find the total number of mice.
Independent Work Time	**Develop**: Students will work on the unit 1, day 7 worksheet. Students will complete the inquiry in their team.
Closing	**Defend**: Students will present their findings to the class. Review the following question: *How can skip counting by five help you multiply?*

Names: _____

Day 7

Driving Question: How can skip counting help us multiply by 5?
Objective: I can use skip counting to help me multiply by 5.

Inquiry: Our school librarian has some boxes of computer mice. They need our help to find out how many mice we have. The mice are in packages. Each package has five mice. You have 6 packages with 5 mice in each package. How many mice in all?

5 mice in each package

6 packages

Our Plan:

Our work

Total number of mice

Addition Sentence:

Multiplication Sentence:

Answer the following: How can skip counting by five help you multiply?

_____

_____

_____

_____

_____

_____

_____

Unit 1
Day 8

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use skip counting to help me multiply by 3 and 4.
Driving Question	How can skip counting help us multiply by 3 and 4?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *How did a peer solve the problem? How was their strategy similar or different from your own?*
Resources:	Unit 1, day 8 Worksheet
Solve and Share/ Problem Solving	Alice has 4 bags of candy. Each bag has 3 pieces of candy. How many pieces of candy does she have?
Guided Practice	**Discovery:** This week we have been helping our school librarian, and today we are going to continue to do that. We have explored the question: *How can skip counting help us multiply?* We will continue to investigate that question with skip counting by 3 and 4. **Devise:** Today we will continue to help our school librarian. We will help them complete the project. Today you will help the librarian find the total number of magazines and pillows.
Independent Work Time	**Develop**: Students will work on their unit 1, day 8 worksheet. Students will create a plan, show their work, and complete the reflection question. Students will use skip counting to help them find their total. They will need to write an addition and multiplication number sentence.
Closing	**Defend:** Students will present their findings to the class. Have a class discussion on: *How can skip counting by four and three help*

	you multiply?

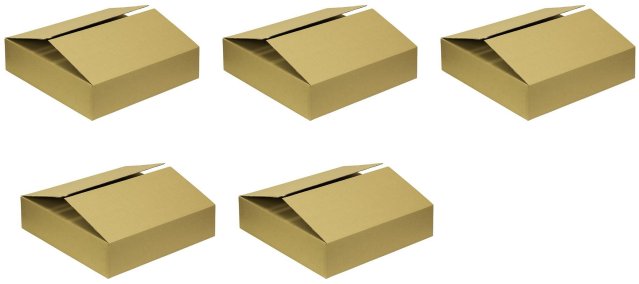
Names:_____

Day 8

Objective: I can use skip counting to help me multiply by 3 and 4.
Driving Question: How can skip counting help us multiply?

Inquiry: Our school librarian still needs our help. Today she has two tasks for us to complete in order for the library to be done. The librarian needs our help finding the number of magazines and pillows.

Task 1 Magazines: The magazines are in some boxes. Each box has 3 magazines. There are five boxes. How many magazines in all?



Our Plan:

Our Work:

Total number of Magazines:

Addition Sentence:

Multiplication Sentence:

Task 2 Pillows: The library has some new pillows. The pillows are in bags. Each bag has 4 pillows. There are 7 bags. How many pillows in all?

Our Plan:

Our Work:

Total Number of Pillows:

Addition Sentence:

Multiplication Sentence:

Answer the following: How can skip counting by four and three help you multiply?

_____

_____

_____

_____

_____

_____

_____

Unit 1
Day 9

Derived Combinations for multiplying by 6: The goal of today is for students to use their understanding of skip counting, to help them multiply larger numbers. This strategy requires students to break apart numbers like 9 into smaller numbers like 4 and 5. Then students can use skip counting to help them multiply by bigger numbers.

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use my understanding of skip counting to multiply by 6.
Driving Question	How can we use our understanding of skip counting to help us multiply by 6?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *What is still challenging for you? What do you have questions on?*
Resources:	Unit 1, Day 9 Worksheet Counters or unifix cubes available to students.
Solve and Share/ Problem Solving	Find 2x4.
Guided Practice	**Discovery:** We have explored skip counting and how that can help us multiply. Today we will continue to investigate how we can use skip counting to help us multiply, only this time I will give you bigger numbers. Our driving question is: *How can we use our understanding of skip counting to help us multiply larger numbers?* We have multiplied numbers that we also know how to skip count by.

	Devise: Today I will give you some multiplication sentences with larger numbers. I want you and your group to investigate how we can use skip counting to help multiply these numbers. For example: if I had to solve 6x4, what can I do to use my understanding of skip counting to help me multiply? I do not know how to skip count by 6. What could we do with the 6 to make it easier for us to multiply?
Independent Work Time	**Develop**: Students create a plan for some things they will try during this investigation. Students will complete the unit 1, day 9 worksheet.
Closing	**Defend**: Students will present their findings. As a class, discuss the following question: *How can we use our understanding of skip counting to help us multiply larger numbers?*

Names:_____

Day 9

Objective: I can use my understanding of skip counting to multiply by six.
Driving Question: How can we use our understanding of skip counting to help us multiply by six?

Skip Counting Warm-Up: Fill in the following table to practice your skip counting.

Twos	2						
Threes			9				
Fours					20		
Fives				20			

Inquiry: You have three multiplication sentences to solve. The goal is to try to use skip counting to help us multiply by 6. How can we make the factor 6 simpler for me to solve?

Our plan:

1. 6x4

2. 6x6

3. 6x7

Answer the following: How can we use our understanding of skip counting to help us multiply by six?

_____

_____

_____

_____

_____

_____

_____

Unit 1
Day 10

Derived Combinations for multiplying by 7: The goal of today is for students to use their understanding of skip counting, to help them multiply larger numbers. This strategy requires students to break apart numbers like 9 into smaller numbers like 4 and 5. Then students can use skip counting to help them multiply by larger numbers.

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use my understanding of skip counting to multiply by 7.
Driving Question	How can we use our understanding of skip counting to help us multiply by 7?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *When you encountered something challenging today, what did you do? What did your group do?*
Resources:	Unit 1, Day 10 worksheet Counters or unifix cubes available
Solve and Share/ Problem Solving	Amy has 2 boxes of toys. Each box has 5 toys in it. How many toys does she have in all?
Guided Practice	**Discovery**: So far in our multiplication unit, we have used skip counting to help us multiply. We continued to use skip counting to help us multiply larger numbers like 6. Today we continue to do that only by multiplying by 7. We will investigate the following question: *How can we use our understanding of skip counting to help us multiply by 7?* **Devise:** Today I will give you some multiplication sentences with larger numbers. I want you and your group to investigate how we can use skip counting to help multiply these numbers.

	For example: if I had to solve 7x4, what can I do to use my understanding of skip counting to help me multiply? I do not know how to skip count by 7. What could we do with the 7 to make it easier for us to multiply?
Independent Work Time	**Develop**: Students will develop a plan with their group. In their group, students will complete the unit 1, day 10 worksheet.
Closing	**Defend:** Students will share their findings with the class. Discuss the following driving question with students: *How can we use our understanding of skip counting to help us multiply by 7?*

Names:_____

Day 10

Objective: I can use my understanding of skip counting to multiply by 7.

Driving Question: How can we use our understanding of skip counting to help us multiply by 7?

Skip Counting Warm-Up: Fill in the following table to practice your skip counting.

Twos				8			
Threes		6					
Fours						24	
Fives				20			

Inquiry: You have three multiplication sentences to solve. The goal is to try to use skip counting to help us multiply by 7. How can we make the factor 7 simpler to solve?

Our Plan:

1. 7x6

2. 7x9

3. 7x7

Answer the following: How can we use our understanding of skip counting to help us multiply by seven?

_____

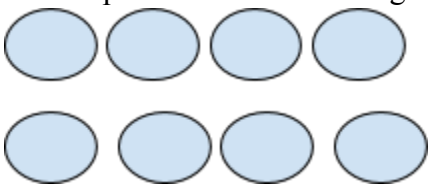
_____

_____

_____

_____

Unit 1
Day 11

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use arrays and equal groups to show and solve multiplication problems.
Driving Question	How can we group objects into equal groups or rows to help us multiply by 6?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *What was the main idea you learned today?*
Resources:	Unit 1, day 11 Worksheet Counters or unifix cubes available to students.
Solve and Share/ Problem Solving	Show a picture of the following array:  Students answer the following question: *What patterns do you notice about this picture? What multiplication sentence does this picture represent?* Allow students time to discuss this question with their small group. Go over the question as a group.
Guided Practice	**Discovery:** We have learned a couple of strategies to help us

	multiply. Today, we are going to learn about equal groups and arrays. We are going to investigate the following question: *How can we group objects into equal groups or rows to help us multiply?* **Devise:** Some of the third graders went apple picking. At the apple orchard, only 6 apples can fit into a bag. Each group picked a different amount of bags. Your job is to help them find their total number of apples using equal groups and rows. Use what you know about skip counting to help you find your totals.
Independent Work Time	**Develop:** Students will develop their plan for how they will create equal groups using the grid paper. They will need to identify the number of groups using this sentence frame: __ groups of __ apples. Next, they will need to identify the multiplication sentence that is represented in their picture and scenario.
Closing	**Defend:** Students will present their findings to the class. Discuss the question: *How can we group objects into equal groups or rows to help us multiply?*

Names:_____

Day 11
Arrays and Equal Groups

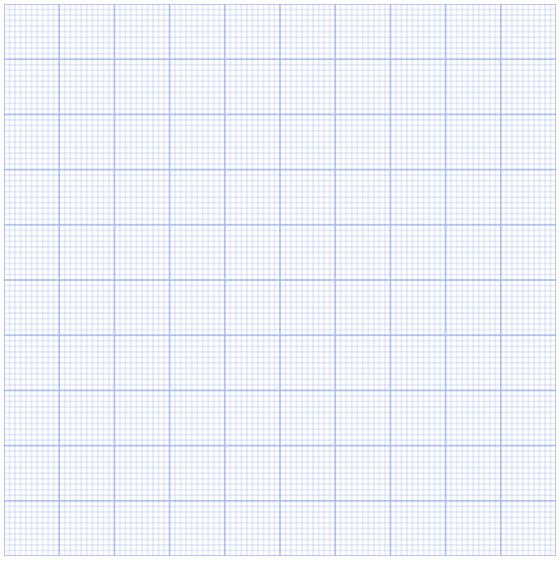
Objective: I can use arrays and equal groups to show and solve multiplication problems
Driving Question: How can we group objects into equal groups or rows to help us multiply by 6?

Inquiry: Third Grade has gone apple picking. Only six apples fit in a bag. Your job is to find the total number of apples using equal groups and rows. Remember to use what you know about skip counting to help you find the total number of apples. Use the grid paper to create your rows and equal groups.

Practice:

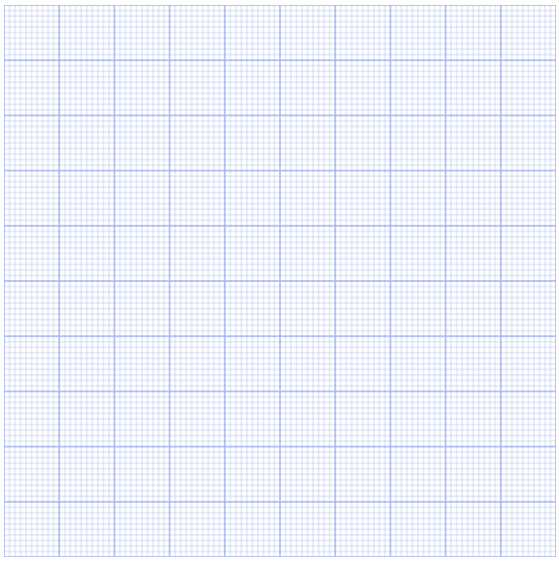
2 groups of 3 apples.

2 X 3 = 6



Group 1: They collected 3 bags with 6 apples in each bag. How many apples did group 1 collect?

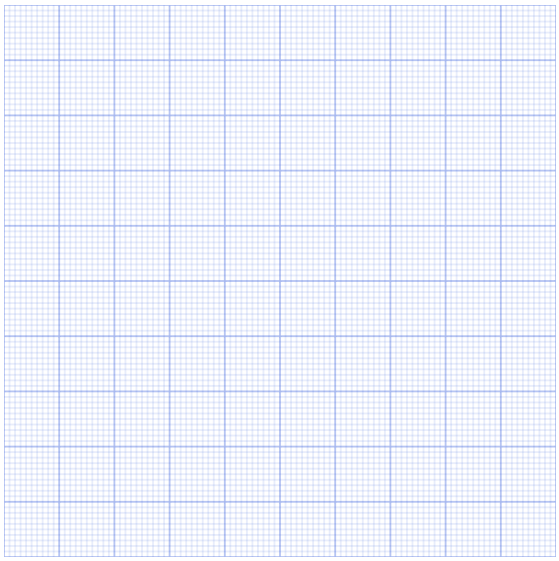
Use the grid paper to show equal groups



__ groups of ___ apples

__ X __=____

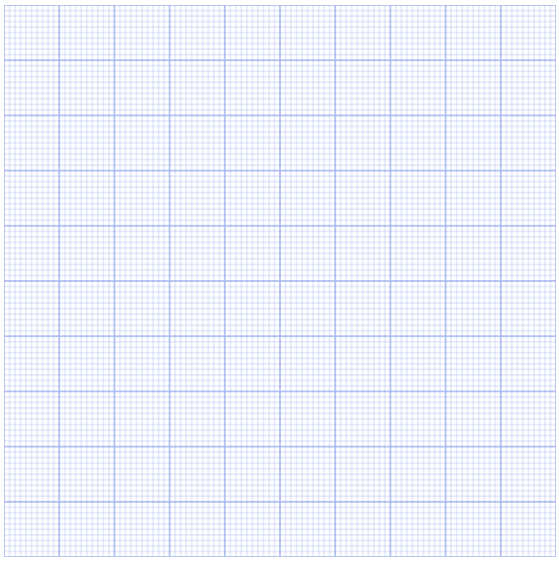
Group 2: They collected 6 bags with 6 apples in each bag. How many apples did group 2 collect?



__ groups of __ apples

___ X ___ = _____

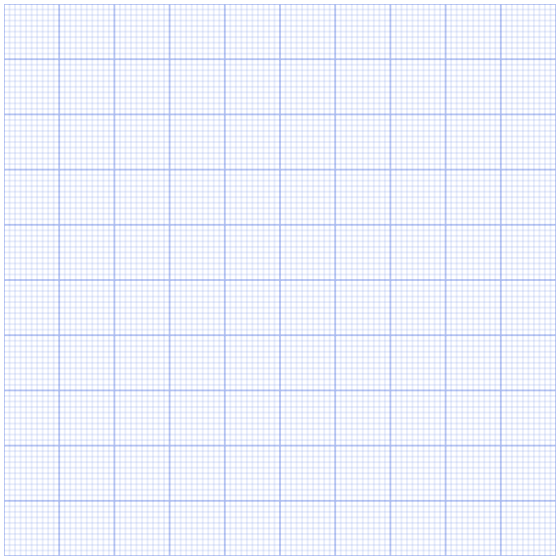
Group 3: They collected 7 bags with 6 apples in each bag. How many apples did they collect in all?



___ groups of ___ apples

___ X ___ = ____

Group 4: Draw a picture of 4 groups of 6 apples.



__ X __ = ____

Answer the following: How can we group objects into equal groups or rows to help us multiply by 6?

_____

_____

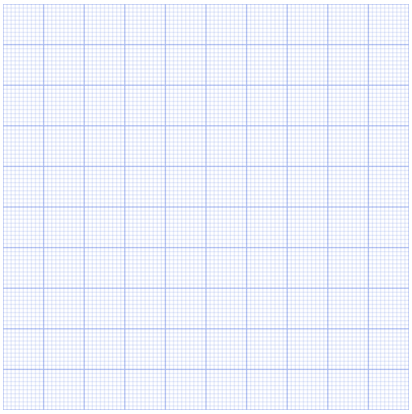
_____

_____

_____

_____

Unit 1
Day 12

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use arrays and equal groups to show and solve multiplication problems.
Driving Question	How can we group objects into equal groups or rows to help us multiply by 7 and 8?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *Explain a misconception or mistake a classmate or you made. What did you learn from the mistake or misconception?*
Resources:	Unit 1, Day 12 Worksheet Students will have counters or unifix cubes available to them
Solve and Share/ Problem Solving	Provide students with grid paper: 

	Draw a picture with 3 groups of 6. Write a multiplication sentence. Find the total.
Guided Practice	**Discovery:** Yesterday we explored creating equal groups and rows to help us multiply by six. Today we are going to continue to explore that strategy, only we will be multiplying by 7 and 8. We will investigate the following question: *How can we group objects into equal groups or rows to help us multiply by 7 and 8?* **Devise:** Our class is having a celebration to celebrate finishing our reading unit (change to fix for your class if needed). We need cups for our juice. The cups come in packages of 7 or 8. I need your help to find the total number of cups for each group. Remember to use equal groups or rows to help solve. Use your understanding of skip counting to help you find a total.
Independent Work Time	**Develop**: Students will work with their group to find the total number of cups in each scenario. Teachers monitor and ask questions to push students thinking and understanding of the content.
Closing	**Defend**: Students will present their findings to the class. Discuss the following question: *How can we group objects into equal groups or rows to help us multiply by 7 and 8?*

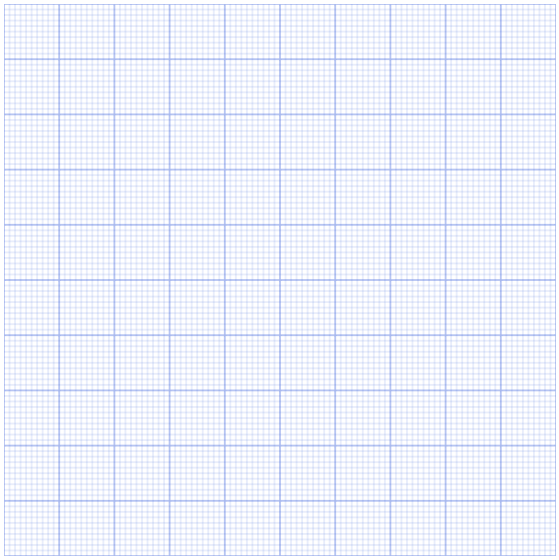
Names: _____

Day 12

Objective: I can use arrays and equal groups to show and solve multiplication problems.
Driving Question: How can we group objects into equal groups or rows to help us multiply by 7 and 8?

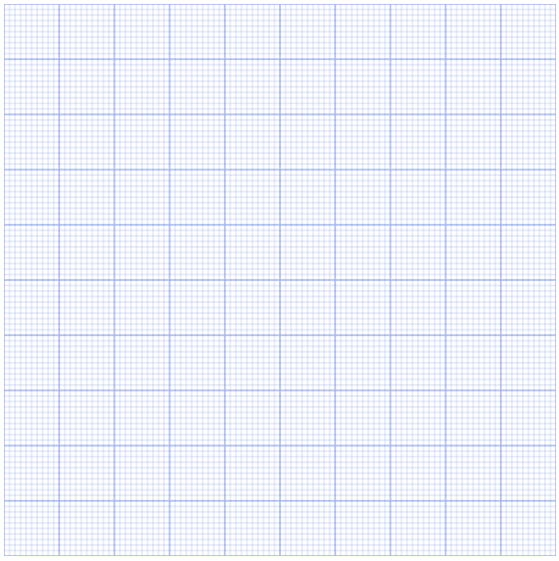
Inquiry: Our class is planning a celebration for finishing our reading unit (or change to some sort of celebration that will best fit your class). We need to get cups for our juice. A package of cups comes with either 7 or 8 cups. Find the total number of cups each group has. Use equal groups or rows to find the total number of cups.

Group 1: They have 7 groups of 5 cups. How many cups do they have in all?



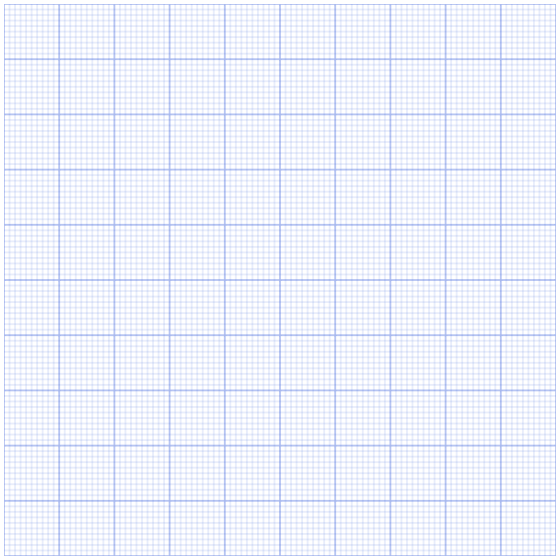
__ groups of ____
___ X ___ = ____

Group 2: They have 7 groups of 3. How many cups in all?



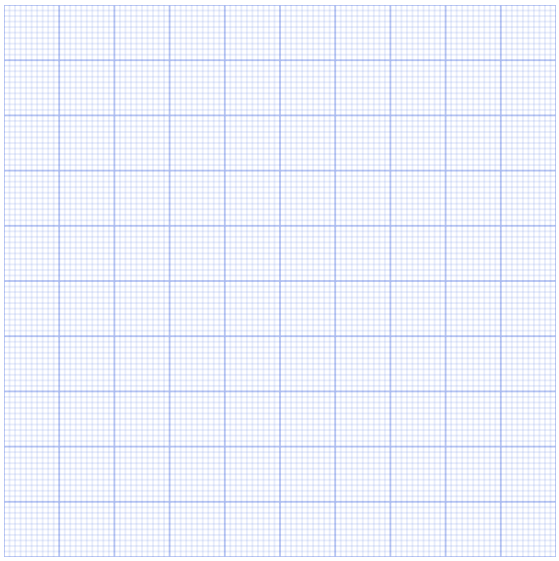
__ groups of ____
___ X ___ = _____

Group 3: They have 8 groups of 4. How many cups in all?



__ groups of __
__ X __ = ___

Group 4: They have 6 groups of 8. How many cups in all?



__ groups of __
__ X __ = ___

Answer the following: How can we group objects into equal groups or rows to help us multiply by 7 and 8?

_____

_____

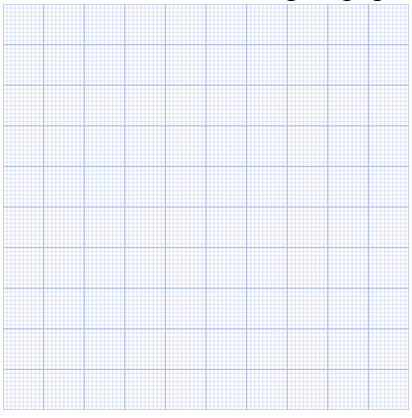
_____

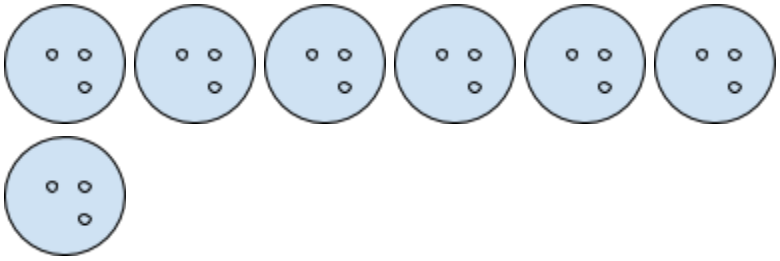
_____

_____

_____

Unit #:1
Day 13

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can use arrays and equal groups to show and solve multiplication problems.
Driving Question	How can we group objects into equal groups or rows to help us multiply by 9?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *What strategy did your group use to solve the inquiry today? Was your strategy successful? What did you learn from your strategy?*
Resources:	Unit 1, Day 13 Worksheet Counters or unifix cubes available to students
Solve and Share/ Problem Solving	Provide students with grid paper:  Draw a picture with 7 groups of 3. Write a multiplication sentence. Find the total.

	Now show students the following:  What is the relationship between your drawing on the grid paper and these circles? Do they both have 7 groups of 3? 1. Students turn and talk 2. Discuss as a class The rows we've created are also known as equal groups. We can use rows and equal groups to help us solve multiplication.
Guided Practice	**Discovery**: We have explored how we can use equal groups and rows to help us multiply by 6, 7, and 8. Today we will explore how we can use equal groups and rows to help us multiply by 9. We will continue to investigate the question: *How can we group objects into equal groups or rows to help us multiply by 9?* Today we are going to explore how rows and equal groups are related. A row in our arrays is also considered an equal group. **Devise**: Our school has some new jump ropes for the playground. The teachers need our help to find out how many jump ropes we have. 9 jump ropes come in the bag. I want you to find two ways to draw __ groups of ___. Try some new ideas with your groups.
Independent Work Time	**Develop**: Students will develop a plan with their group for solving the inquiry. While students are working, the teacher is to walk around and ask students questions to guide their thinking.
Closing	**Defend**: Students will present their findings to the class. Discuss the following questions as a class: 1. *How can we group objects into equal groups or rows to help us multiply by 9?* 2. *How are equal groups and rows in an array similar?*

Names: _____

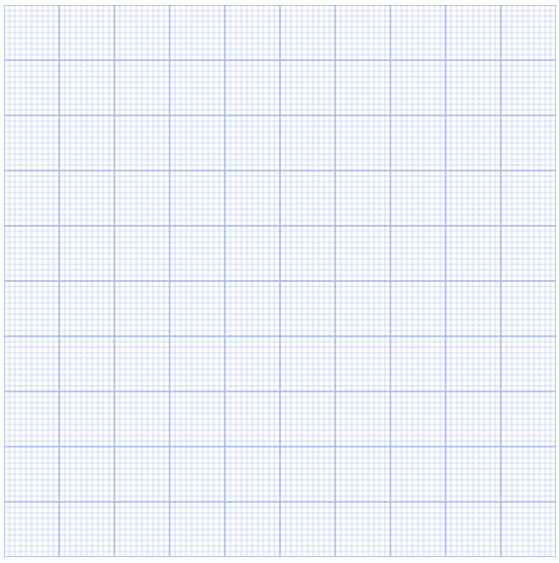
Day 13

Objective: I can use arrays and equal groups to show and solve multiplication problems

Driving Question: How can we group objects into equal groups or rows to help us multiply by 9?

Inquiry: The school has some new toys for our playground. The teachers need your help to find the total number of jump ropes. 9 jump ropes come in a bag. For each group, show two ways to draw __ groups of __ jump ropes.

Group One: Draw 9 groups of 5



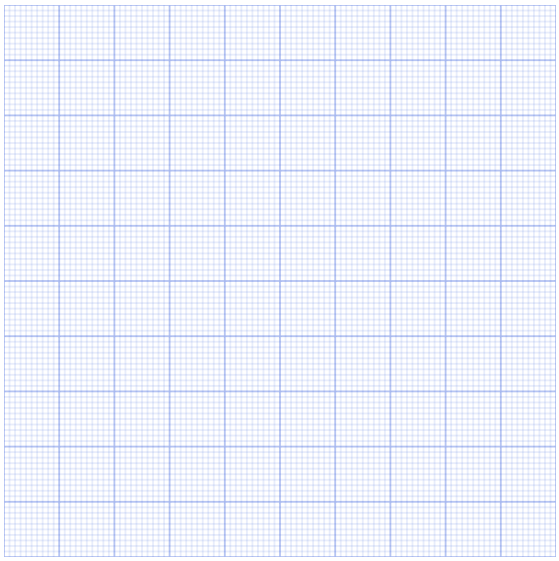
__ groups of ___

__ X __ = __

Another way to show 9 groups of 5:

__ X __ = __

Group Two: Draw 3 groups of 9.

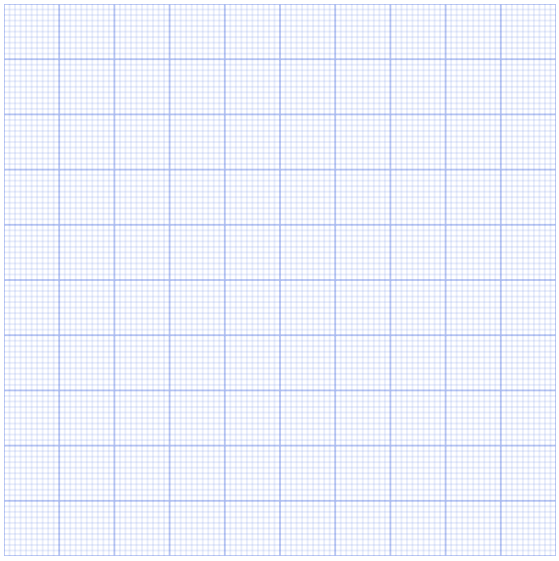


__ groups of ___
__ X __ = __

Another way to show 3 groups of 9:

__ X __ = __

Group Three: Draw 9 groups of 7.



__ groups of ___
__ X __ = __

Another way to show 9 groups of 7:

__ X __ = __

Answer the following:

How can we group objects into equal groups or rows to help us multiply by 9?

_____

_____

_____

_____

_____

_____

How are equal groups and rows in an array similar?

_____

_____

_____

_____

_____

_____

Unit 1
Day 14

Standard:	**3.1.2.3** Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division. **3.1.2.4** Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.
Student Objective/Goal:	I can break apart unknown facts into known facts to solve multiplication problems.
Driving Question	How can we break apart unknown facts into known facts to help us solve multiplication problems?
Math Mindset Discussion/Question	At the end of the inquiry students will answer the following question in their math journal: *How did a peer solve the problem? How was their strategy similar or different from your own?*
Resources:	Unit 1, Day 14 Worksheet Counters or unifix cubes available to students
Solve and Share/ Problem Solving	Draw 4 groups of 9.
Guided Practice	**Discovery:** We have explored using equal groups and rows to help us multiply. Today we are going to explore how we can break apart unknown facts into known facts to help us multiply. We are going to investigate the following question: *How can we break apart unknown facts into known facts to help us solve multiplication problems?* **Devise:** Today we will try to use known facts to help us solve multiplication problems with unknown facts. You and your group will problem solve your known facts and how you can use those to solve unknown facts.

Independent Work Time	**Develop:** Students will develop a plan with their group. They will work together to solve the equations. Potential teacher questions to guide student thinking: ● *How can we break this number into factors we do know?* ● *What are some other ways we can break apart this factor?* ● *Now that you have broken apart the factor, what do you do next?*
Closing	**Defend:** Students will present their findings to the class. Students will answer the following question: *How can we break apart unknown facts into known facts to help us solve multiplication problems?* Students will share their strategies and explain their thinking behind how they broke apart unknown facts into known facts.

Names:_____

Unit 1, Day 14

Objective: I can break apart unknown facts into known facts to solve multiplication problems.
Driving Question: How can we break apart unknown facts into known facts to help us solve multiplication problems?

Inquiry: Solve the following problems. Remember to try to break apart unknown facts into known facts to help us solve.

Our plan: What are our known facts?

-
-
-
-
-

Let's try to use those known facts to help us solve unknown facts!

1. Solve 9x3

2. Solve 8x8

3. Solve 4x8

4. Solve 5x7

5. Solve 6x3

6. Solve 8x4

Answer the following question: How can we break apart unknown facts into known facts to help us solve multiplication problems?

_____

_____

_____

_____

_____

_____

Unit 1
Day 15
Day for assessment

The purpose of today is to assess students' understanding of multiplication, while also giving them some time to reflect on their math mindset. Students will be given the opportunity to compare their math mindset at the start of the unit to what it is at the end of this math unit. After completing the math mindset post-assessment, students will reflect on their math mindset. This will occur on day 16.

Name: _____

Unit 1 Assessment

3.1.2.3 Represent multiplication facts using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. Recognize the relationship between multiplication and division.
3.1.2.4 Solve real-world and mathematical problems involving multiplication and division, including both "how many in each group" and "how many groups" division problems.

Solve the following any way you choose. Make sure to show your work.

1. 2x5

2. 4x6

3. 7x6

4. 9x3

5. 7x8

6. 4x8

7. **How are multiplication and addition related?**

_____

_____

_____

_____

_____

8. How might you use multiplication in your everyday life?

_____

_____

_____

_____

_____

9. What questions do you still have about multiplication?

_____

_____

_____

_____

_____

10. What were some of your strengths and weaknesses in this unit? What is your plan to improve your weaknesses?

_____

_____

_____

_____

_____

Name:_____

Math Mindset Post-Assessment

What do you do when a math task gets hard?

E. Keep trying
F. Get frustrated
G. Give up
H. Ask for help

How do you feel about math?

_____

_____

_____

_____

_____

How do you feel when you make a mistake in math?

_____

_____

_____

_____

_____

Do you think everyone can be good at math?

c. Yes
d. No

What do you like about math?

What do you dislike about math?

Unit 1
Day 16
Math Mindset Reflection

Student Objective/Goal:	I can reflect on my math mindset by comparing my pre and post assessments.
Driving Question	How has your math mindset changed throughout this unit?
Resources:	Math mindset pre-assessment Math mindset post-assessment
Solve and Share/ Problem Solving	Read the sentences below. Identify if the student is displaying a fixed or a growth mindset? 1.*This is hard and I hate it.* *2. This is challenging, but I am going to keep working through it.* *3.I am the best at math, but not a science person.* *4.Let's work together on this difficult task.* Students are given opportunities to discuss the following prompts with their group after having time to think. **Class discussion on the prompts:** 1.What language do you notice the student using who has a growth mindset? 2. What language do you notice the students with the fixed mindset using? 3. How would you respond to the student with the fixed mindset? What could we do to help that student feel differently about the task?
Guided Practice	We are going to now take some time to reflect on our math mindsets. Here I have my pre and post assessment. We are going to look for any patterns or changes in our math mindset throughout this unit. **Model/think aloud for how we compare the two assessments**: "I notice.." "I used to think___. Now I think____." You are going to use the same sentence starters to compare your two assessments.

Independent Work Time	Students will be given time to reflect on their pre and post math mindset assessments. Students will use these two sentence frames to help: "I notice____." "I used to think _____. Now I think _____." **Teacher questions to ask to guide student thinking**: 1.*What patterns do you notice?* *2.Why do you think that changed?* *3.What changes do you notice?* After giving students time to work independently, allow students to share some of their findings with their group.
Closing	Teacher will ask students to share some of their findings with the whole group. Teachers will ask students: How can we apply these new findings and learning into our next math unit and in our lives?

REFERENCES

Boaler, J., & Dweck, C. (2015). *Mathematical mindsets: unleashing students' potential through creative math, inspiring messages and innovative teaching*. John Wiley & Sons, Incorporated.

Maryland Public Schools.(2020). *Learning Trajectories for Primary Grades Mathematics Developmental Levels.*

http://marylandpublicschools.org/about/Documents/DCAA/Math/MGLCR/PreK-5/BuildingBlockLearningTrajectories.pdf

Wiggins, G., & McTighe, J. (2011). *The understanding by design guide to creating High-Quality Units*. Association for Supervision & Curriculum Development.